

Specifications for

TFT-LCD Monitor

Version 2.0

MODEL COM57T5M54ZSC

Customer's Approval

Signature:

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Section:

Title:

Date:

ORTUSTECH

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Version History

Ver.	Date	Page	Description
1.0	Apr. 19, 2012	-	- First issue
2.0	Sep. 3, 2012  ×8	P.6	3.2 Outward Form
		Change	Company name for connector
		Change	Specification (S LABEL)
		P.7	3.3 SEREAL LABEL (S-LABEL)
		Change	Specification (S LABEL)
		P.8	4.1 Display Module Part
		Change	Company name for connector
		P.21	12. Reliability Test
		Correct	Impact test JIS №

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1. Application

This Specification is applicable to 14.4 cm (5.7 inch) TFT-LCD monitor for non-military use.

- ◎ ORTUS TECHNOLOGY makes no warranty or assume no liability that use of this Product and/or any information including drawings in this Specification by Purchaser is not infringing any patent or other intellectual property rights owned by third parties, and ORTUS TECHNOLOGY shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains ORTUS TECHNOLOGY's confidential information and copy right, Purchaser shall use them with high degree of care to prevent any unauthorized use, disclosure, duplication, publication or dissemination of ORTUS TECHNOLOGY'S confidential information and copy right.
- ◎ If Purchaser intends to use this Products for an application which requires higher level of reliability and/or safety in functionality and/or accuracy such as transport equipment (aircraft, train, automobile, etc.), disaster-prevention/security equipment or various safety equipment, Purchaser shall consult ORTUS TECHNOLOGY on such use in advance.
- ◎ This Product shall not be used for application which requires extremely higher level of reliability and/or safety such as aerospace equipment, telecommunication equipment for trunk lines, control equipment for nuclear facilities or life-support medical equipment.
- ◎ ORTUS TECHNOLOGY assumes no liability for any damage resulting from misuse, abuse, and/or miss-operation of the Product deviating from the operating conditions and precautions described in the Specification.
- ◎ If any issue arises as to information provided in this Specification or any other information, ORTUS TECHNOLOGY and Purchaser shall discuss them in good faith and seek solution.
- ◎ ORTUS TECHNOLOGY assumes no liability for defects such as electrostatic discharge failure occurred during peeling off the protective film or Purchaser's assembly process.
- ◎ This Product is compatible for RoHS directive.

Object substance	Maximum content [ppm]
Cadmium and its compound	100
Hexavalent Chromium Compound	1000
Lead & Lead compound	1000
Mercury & Mercury compound	1000
Polybrominated biphenyl series (PBB series)	1000
Polybrominated biphenyl ether series (PBDE series)	1000

(6/28)
 11TLM102
 Issue: Sep. 3, 2012

※ The hatching area is recommended holding area.
 Recommended weight: Parallel 2kgf

2.20 ± 0.50

2.21 ± 0.50

2.01 ± 0.50

62.30
 79.60
 (97.20)

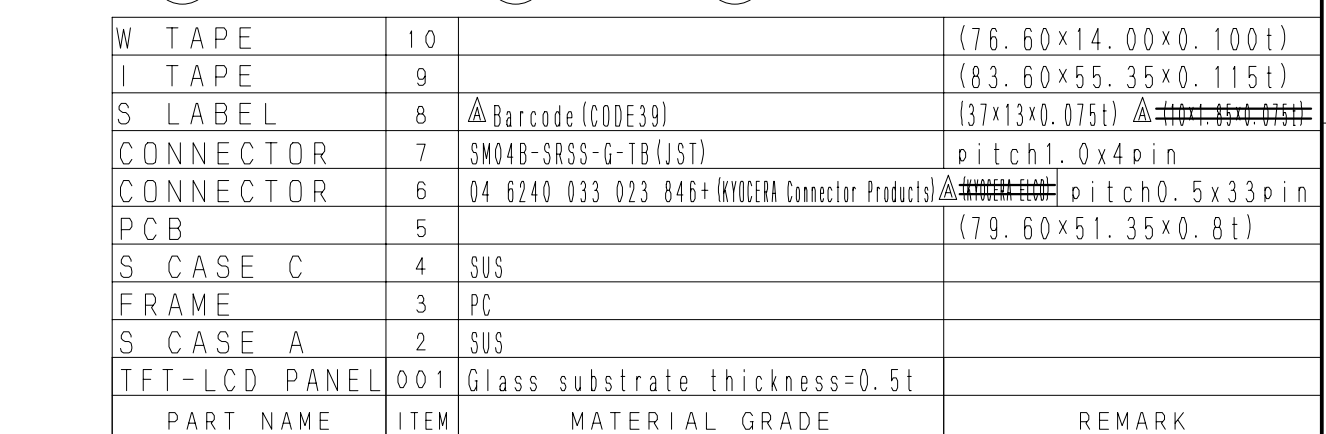
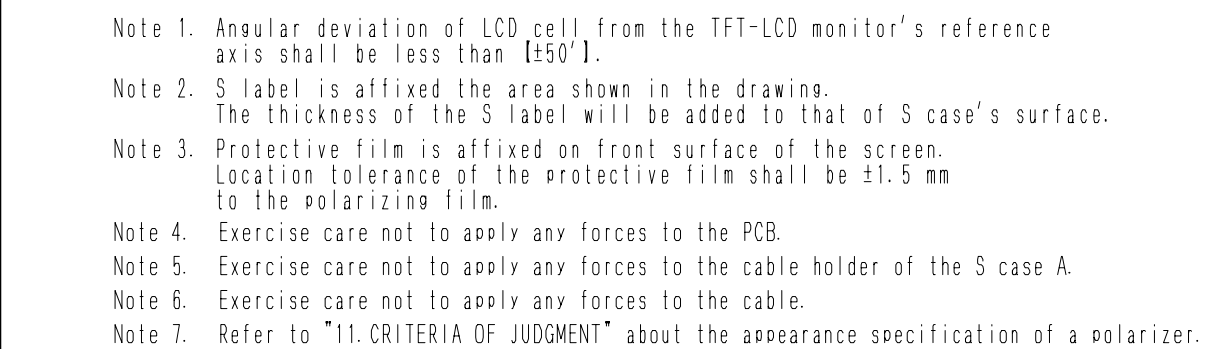
6.80
 (Range that can be bent)

12.00
 (16.29)

GND pad (4 places)
 There should not be any conductive material around the GND pad.

Barcode (CODE39)
 04 6240 033 023 846+ (KYOCERA Connector Products)

	(76.60×14.00×0.100t)
	(83.60×55.35×0.115t)
△ Barcode (CODE39)	(37×13×0.075t) △ (10×1.85×0.075t)
SM04B-SRSS-G-TB (JST)	pitch 1.0x4pin
04 6240 033 023 846+ (KYOCERA Connector Products)	△ KYOCERA ELEC pitch 0.5x33pin
	(79.60×51.35×0.8t)
SUS	
PC	
SUS	
1 Glass substrate thickness=0.5t	
EM MATERIAL GRADE	REMARK
± 1.0	SCALE 1 / 1
0 1 : 0 6	UNIT mm
	MODEL COM57T5M54Z**
	ORTUSTECH
	ORTUS TECHNOLOGY CO., LTD.
	DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY
	DRAWING No.
	REV.
	SHEET
	DIV.
	JTLINE-D5M54
	RJD523516D301



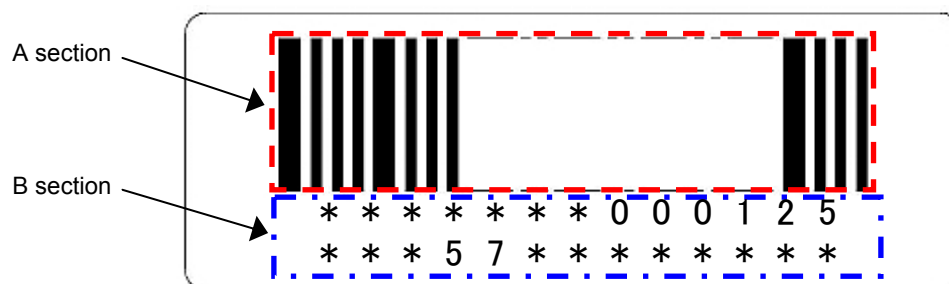
H
2004. 2 DEVICE-TFT

3.3 SERIAL LABEL (S-LABEL)

1) Display Items

A section : Bar code

B section : Combination of a character



Details of B section

Upper column: It indicates The least significant digit of manufacture year (1 digit),
 manufacture month with below alphabet (1letter), model code (5characters),
 serial number (6digits).

*	*	*****	*****
—	—	—	—
a	b	c	d

	Contents of display						
a	The least significant digit of manufacture year						
b	Manufacture month	Jan-A	Mar-C	May-E	Jul-G	Sep-I	Nov-K
		Feb-B	Apr-D	Jun-F	Aug-H	Oct-J	Dec-L
c	Model code	57DEC (Made in Japan) 57DFC (Made in Malaysia) 57DGC (Made in China)					
d	Serial number						

* Example of indication of Serial label (S-label)

•Made in Japan

2E57DEC000125

means "manufactured in May 2012, 5.7" DE type,
 C specifications, serial number 000125"

•Made in Malaysia

2E57DFC000125

means "manufactured in May 2012, 5.7" DF type,
 C specifications, serial number 000125"

•Made in China

2E57DGC000125

means "manufactured in May 2012, 5.7" DG type,
 C specifications, serial number 000125"

Lower column: Model (13characters)

2) Location of Serial Label (S-label)

Refer to 3.2 "Outward Form".

2) Others

Bar code readability is excluded from quality assurance coverage.

4. Pin Assignment

4.1 Display Module Part

No.	Symbol	Function
1	GND	GND.
2	CLK	Clock signal.Latching data at the falling edge.
3	HSYNC	Horizontal sync signal input.(negative polarity)
4	VSNC	Vertical sync signal input.(negative polarity)
5	GND	GND.
6	R 0	Display data input for (R). 00h for black display R0:LSB R5:MSB Driver IC carries out gamma conversion internally.
7	R 1	
8	R 2	
9	R 3	
10	R 4	
11	R 5	
12	GND	GND.
13	G 0	Display data input for (G). 00h for black display G0:LSB G5:MSB Driver IC carries out gamma conversion internally.
14	G 1	
15	G 2	
16	G 3	
17	G 4	
18	G 5	
19	GND	GND.
20	B 0	Display data input for (B). 00h for black display B0:LSB B5:MSB Driver IC carries out gamma conversion internally.
21	B 1	
22	B 2	
23	B 3	
24	B 4	
25	B 5	
26	GND	GND.
27	ENAB	Input data effective signal. (It is effective for the period of "Hi")
28	VDD	Power supply input.
29	VDD	Power supply input.
30	RL	Horizontally Flipped (right/left) Signal. (Lo: Horizontally Flipped Display, Hi: Normal display) NOTE1
31	UD	Vertically Flipped (up/down) Signal. (Lo: Normal display,Hi: Vertically Flipped Display) NOTE1
32	DISP	Display on/off control signal.(Lo : display off, Hi: display on) NOTE2
33	GND	GND.



- Used connector : KYOCERA Connrector Products 6240 series [04 6240 033 023 846+]
- Please refer to the section "3.2 Outward Form" for pin terminal order.
- The corrosion phenomenon by the different kind metal uniting is generated according to the system requirements, and there is a possibility of becoming a loose connection.
Please select very carefully, and design the FPC cable used.
- NOTE1: If not use , Please let it no connected. NOTE2 : If not use , Please let it connected to VDD.

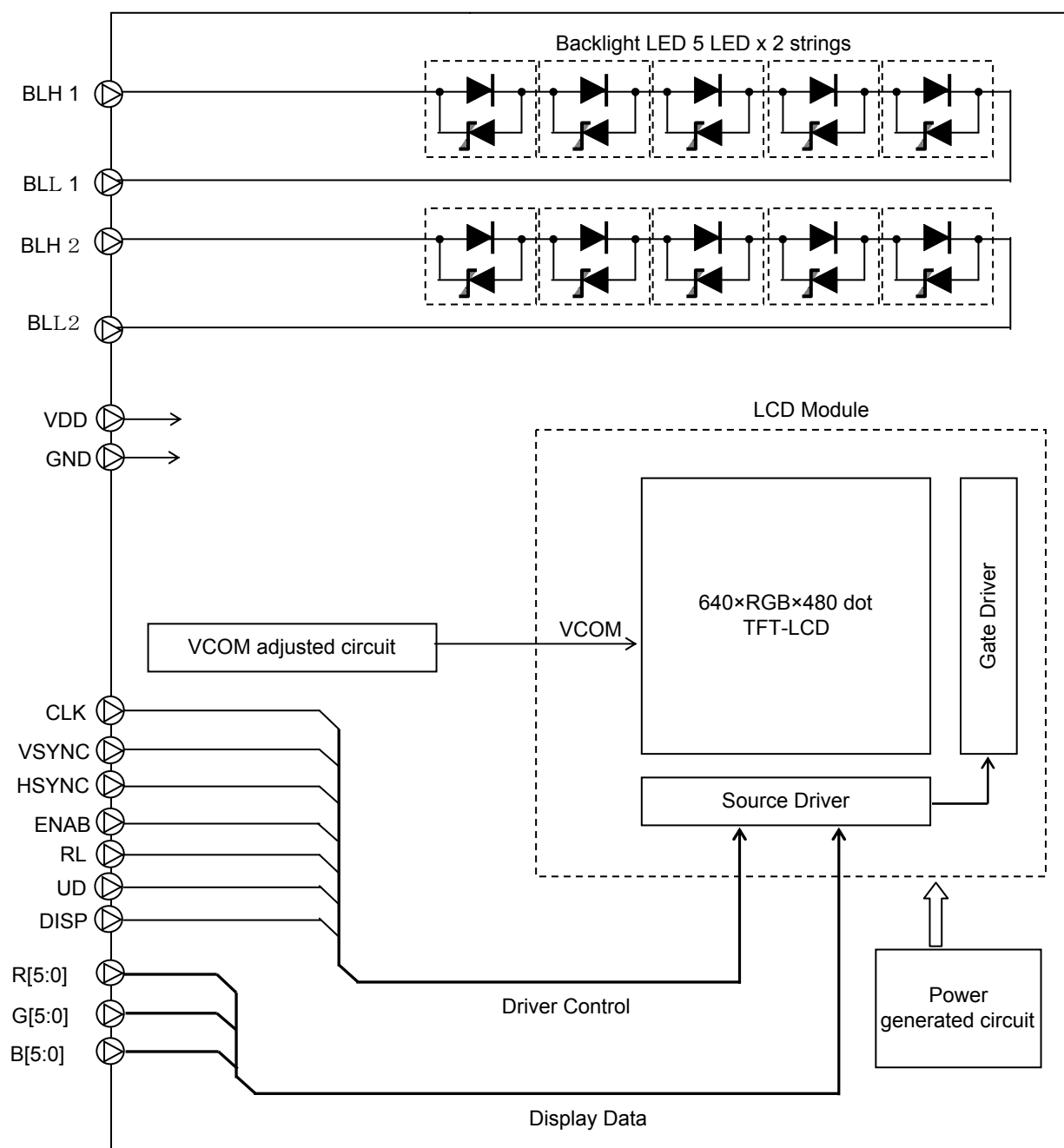
4.2 Backlight Part

No.	Symbol	Function
1	BLL2	Backlight drive 2 (cathode side).
2	BLL1	Backlight drive 1 (cathode side).
3	BLH2	Backlight drive 2 (anode side).
4	BLH1	Backlight drive 1 (anode side).

- Used connector: JST [SM04B-SRSS-G-TB(LF)(SN)]
- Please refer to the section "3.2 Outward Form" for pin terminal order.
- The corrosion phenomenon by the different kind metal uniting is generated according to the system requirements, and there is a possibility of becoming a loose connection.
Please select very carefully, and design the contact used.

5. Block Diagram

Each arrow shows signal flow.



6. Absolute Maximum Rating

VSS=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VDD	Ta=25°C	-0.3	6.0	V	VDD
Input voltage for logic	VI		-0.3	VDD+0.3	V	CLK,VSYNC,HSYNC,ENAB B[5:0],G[5:0],R[5:0], RL,UD,DISP
LED forward current	IL		--	70	mA	BLH1-BLL1,BLH2-BLL2
Storage temperature range	Tstg		-30	80	°C	
Storage humidity range	Hstg	Non condensing in an environmental moisture at or less than 40°C90%RH.				

Note: Please input the logic signal after turning on VDD. Do not input the logic signal while blocking VDD.

Absolute maximum ratings is parametric values , should never be exceed any value at any moment .

Beyond which, it could be suffered from changes in characteristics and never be restored .

Moreover, it could even be suffered from permanent destruction.

Therefore, please note enough the fluctuation of input voltage, the characteristics of connected parts,

I/O signal line surge, and ambient temperature, on designing the circuit.

7. Recommended Operating Conditions

VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VDD		3.0	3.3	3.6	V	VDD
Input voltage for logic	VI	VDD=3.0~ 3.6V	0	--	VDD	V	CLK,VSYNC, HSYNC,B[5:0], G[5:0],R[5:0], ENAB,RL,UD,DISP
Operating temperature range	Top	Note1,2	-20	25	70	°C	Panel surface temperature
Operating humidity range	Hop	Ta≤40°C	20	--	85	%	
		Ta>40°C	Non condensing in an environmental moisture at or less than 40°C85%RH.				

Note1: The temperature within the display will increase due to the heat radiated from the back light while in operation.

Necessary measures have to be taken in the product design to make sure that the display has proper ventilation so that temperature on any surface of this display should not exceed 70°C.

Note2: This monitor is operatable in this temperature range. With regard to optical characteristics, refer to Item "10. CHARACTERISTICS".

8. Characteristics

8.1 DC Characteristics

8.1.1 Display Module

(Unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$, $V_{SS}=0\text{V}$)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input voltage for logic	V_{IH}		$0.7 \times V_{DD}$	--	V_{DD}	V	CLK, VSYNC, HSYNC, ENAB, B[5:0], G[5:0], R[5:0], RL, UD, DISP
	V_{IL}		0	--	$0.3 \times V_{DD}$	V	
Pull down resistor value	Rpd		300	450	600	k Ω	ENAB, B[5:0], G[5:0], R[5:0]
Pull up resistor value	Rpu		300	450	600	k Ω	DISP
Current consumption	IDD	fCLK=25MHz Color bar display	--	140	280	mA	VDD

8.1.2 Backlight

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL	$T_a=25^{\circ}\text{C}$	--	50	70	mA	BLH1 — BLL1
Forward voltage	VL	$T_a=25^{\circ}\text{C}$, IL= 50 mA	--	15.0	17.0	V	BLH2 — BLL2
Estimated Life of LED	LL	$T_a=25^{\circ}\text{C}$, IL= 50 mA Note	--	70,000	--	hr	

Note: - The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.

- This figure is given as a reference purpose only, and not as a guarantee.
- This figure is estimated for an LED operating alone.
As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

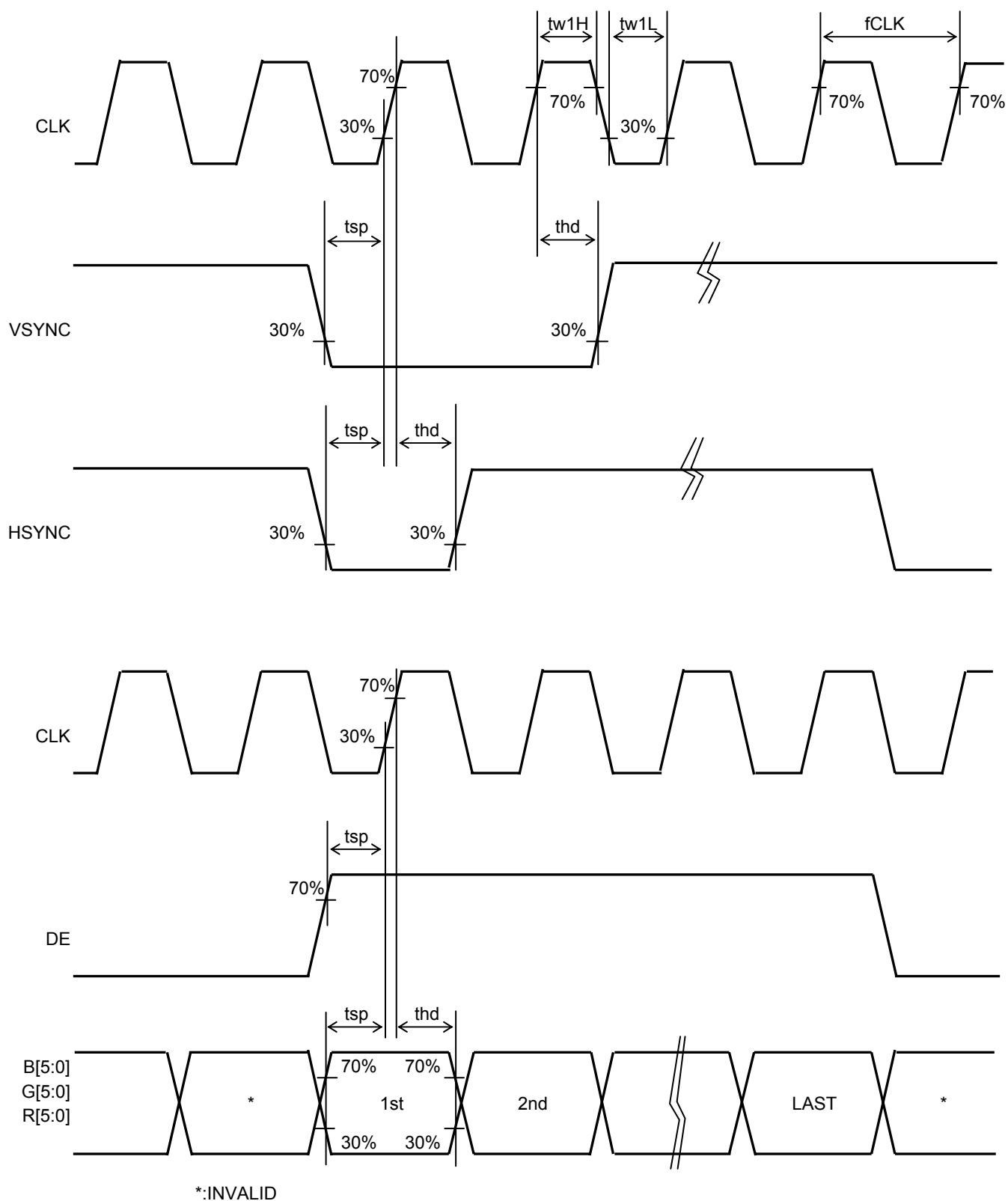
8.2 AC Characteristics

8.2.1 Display Module

(Unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$, $V_{SS}=0\text{V}$)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
CLK frequency	fCLK		--	25	27	MHz	CLK
CLK Low period	tw1L	$0.3 \times V_{DD}$ or less	14.8	--	--	ns	CLK
CLK High period	tw1H	$0.7 \times V_{DD}$ or more	14.8	--	--	ns	CLK
Setup time	tsp		10	--	--	ns	CLK, ENAB, B[5:0], G[5:0], R[5:0], HSYNC, VSYNC
Hold time	thd		10	--	--	ns	

Switching Waveform Characteristics



8.3 Input Timing Characteristics

Item	Symbol	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
CLK frequency	fCLK	--	25	27	MHz	CLK
VSYNC signal cycle time	tv	--	525	--	H	VSYNC,HSYNC
VSYNC frequency Note1	fVSYNC	54	60	66	Hz	VSYNC
VSYNC pulse width	tw2H	1	3	5	H	VSYNC,HSYNC
Vertical back porch	tvb	--	35	--	H	VSYNC,HSYNC,ENAB,B[5:0], G[5:0],R[5:0]
Vertical display period	tvdp	--	480	--	H	
HSYNC signal cycle time	th	--	800	--	CLK	HSYNC,CLK
HSYNC pulse width	tw3H	5	30	--	CLK	
Horizontal back porch	thb	112	--	144 Note 2	CLK	HSYNC,CLK,ENAB,B[5:0], G[5:0],R[5:0]
Horizontal display period	thdp	--	640	--	CLK	
DE pulse width	tw4H	--	640	--	CLK	ENAB,CLK

Note1: The characteristic of this item is recommended standard.

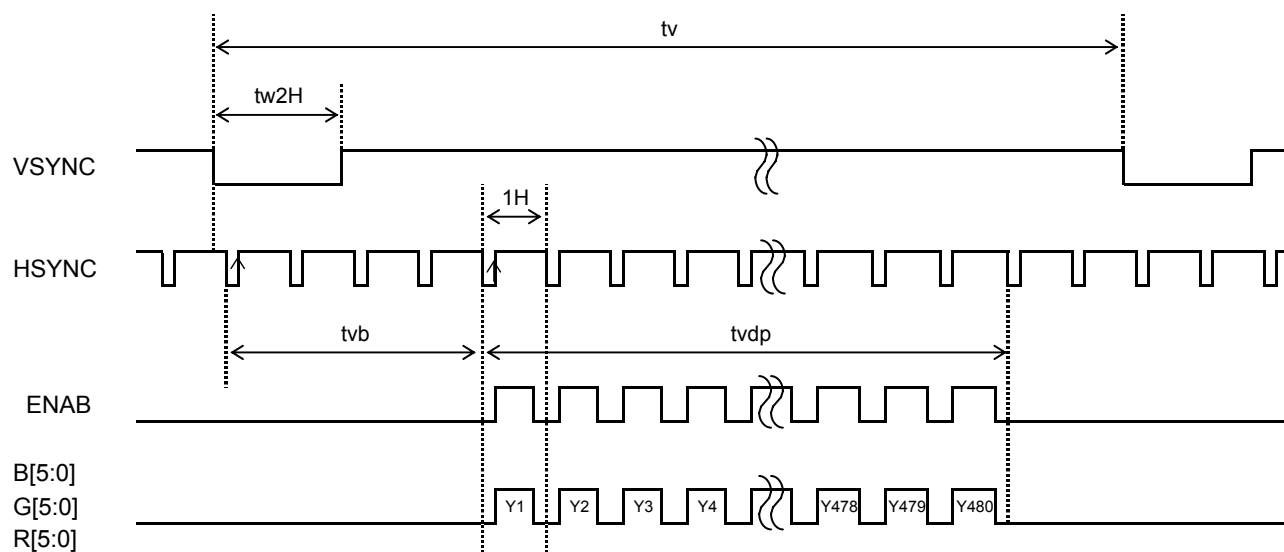
Please use it after it confirms it enough like the display fineness etc.

When it comes off from this characteristic and it is used.

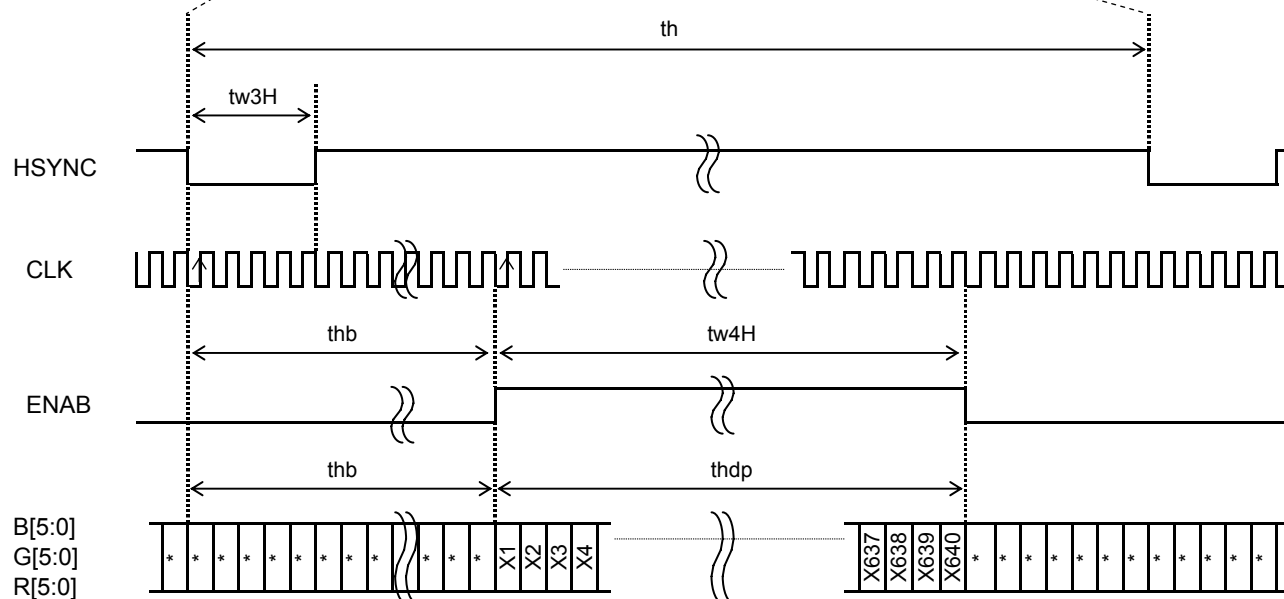
Note2: When "ENAB" keeps "Lo" for 144CLK or longer,start capturing data automatically from 144CLK.

8.4 Driving Timing Chart

-Vertical Timing

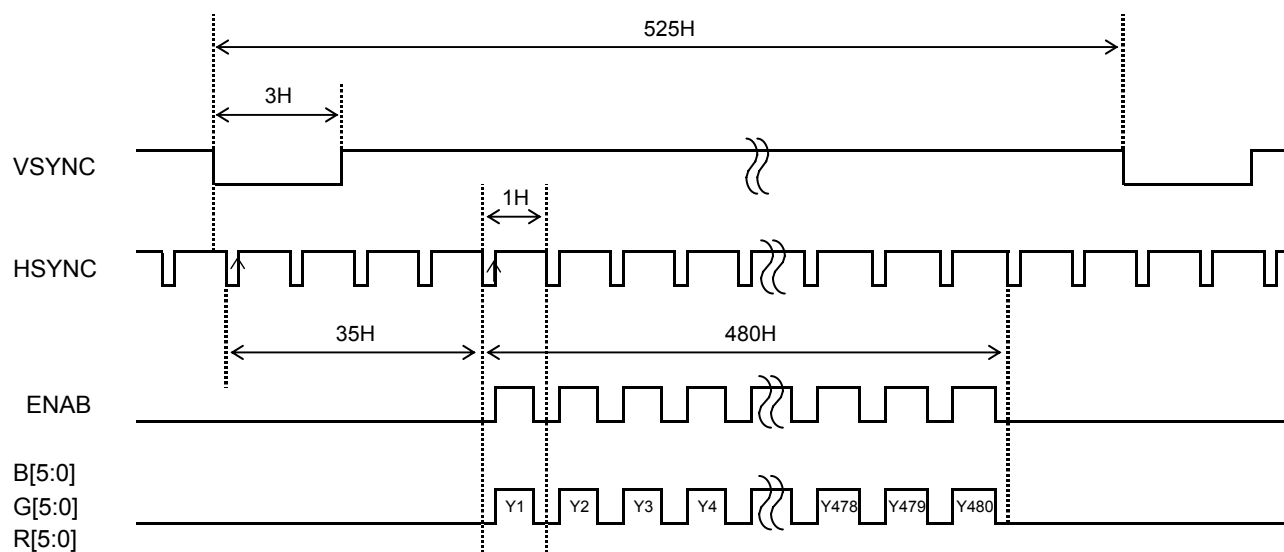


-Horizontal Timing

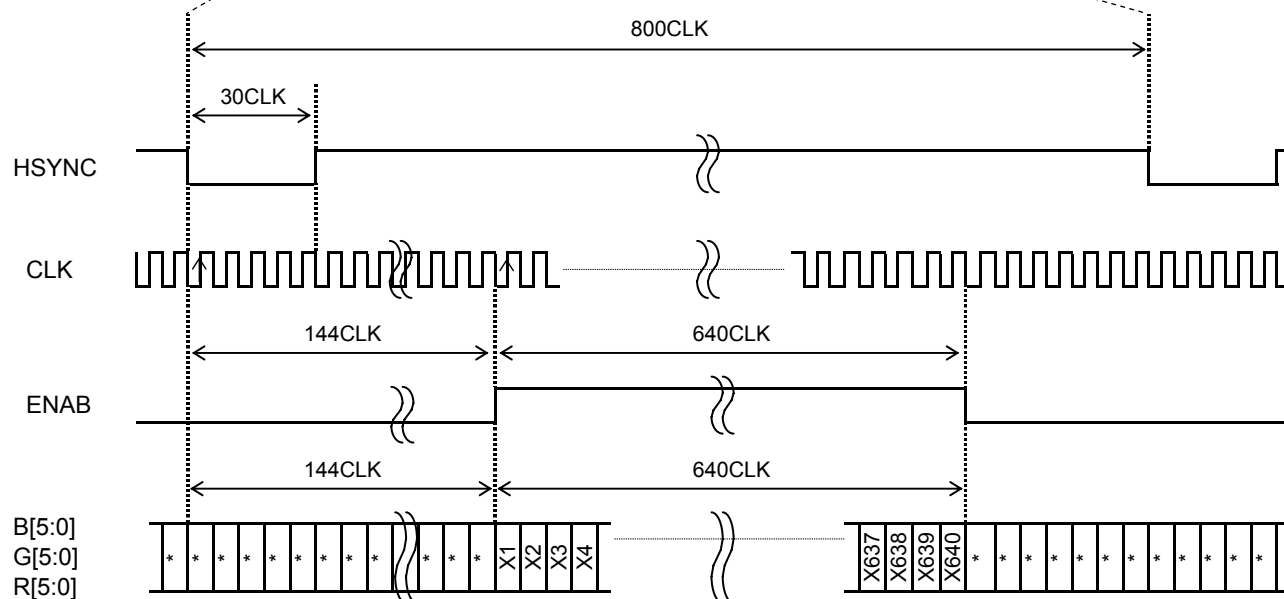


8.5 Example of Driving Timing Chart (fCLK=25MHz)

-Vertical Timing



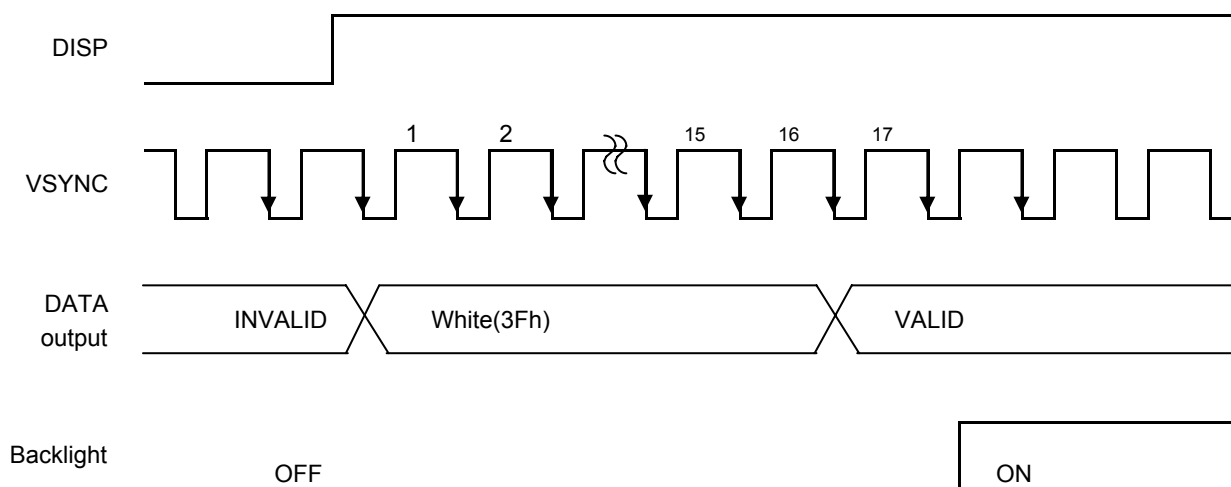
-Horizontal Timing



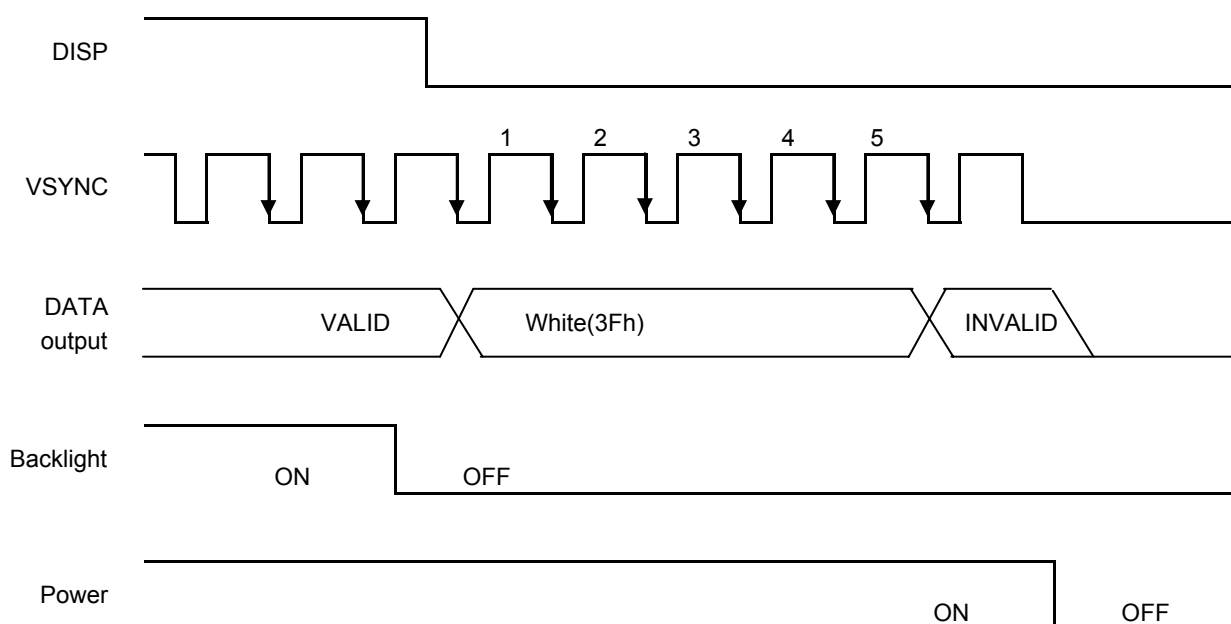
9. "DISP" on/off Sequence

It explains the Display on/off sequence.

After Display on, "White" data is outputted for 16-Frames first, from the falling edge of the following VSYNC signal.



After Display off, "White" data is outputted for 5-Frames first, from the falling edge of the following VSYNC signal. Please turn off the power supply promptly after OFF of "DISP".



10. Characteristics

10.1 Optical Characteristics

< Measurement Condition >

Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS),
EZcontrast160D (ELDIM)

Driving condition: VDD = 3.3V, VSS = 0V
Optimized VCOMDC

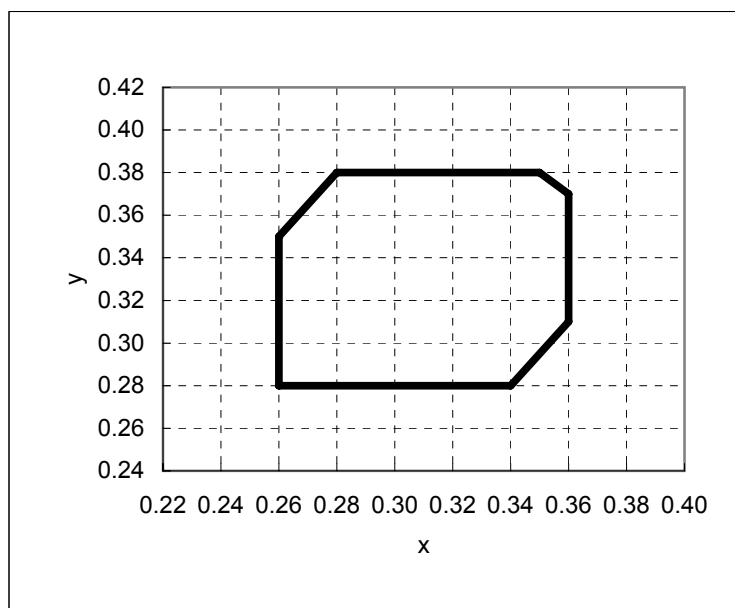
Backlight: IL=50mA

Measured temperature: Ta=25° C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON	[Data]=3Fh→00h	—	—	40	ms	1	※
	Fall time	TOFF	[Data]=00h→3Fh	—	—	60	ms		
Contrast ratio		CR	[Data]=3Fh/00h	360	700	—		2	
Viewing angle	Left	θL	[Data]=3Fh/00h CR ≥ 10	80	—	—	deg	3	※
	Right	θR		80	—	—	deg		
	Up	φU		55	—	—	deg		
	Down	φD		80	—	—	deg		
White Chromaticity		x	[Data]=3Fh	White chromaticity range				4	
		y							
Burn-in				No noticeable burn-in image should be observed after 0.5 hours of window pattern display.				5	
Center brightness			[Data]=3Fh	230	440	—	cd/m ²	6	
Brightness distribution			[Data]=3Fh	70	—	—	%	7	

* Note number 1 to 7: Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".

※ Measured in the form of LCD module.



【White Chromaticity Range】

x	y
0.26	0.35
0.26	0.28
0.27	0.28
0.34	0.28
0.36	0.31
0.36	0.37
0.35	0.38
0.28	0.38

10.2 Temperature Characteristics

< Measurement Condition >

Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS)

Driving condition: VDD = 3.3V, VSS = 0V

Optimized VCOMDC

Backlight: IL=50mA

Item			Specification		Remark
			Ta = -10 °C	Ta = 70 °C	
Contrast ratio		CR	40 or more	40 or more	
Response time	Rise time	TON	200 msec or less	30 msec or less	※
	Fall time	TOFF	300 msec or less	50 msec or less	※
Display Quality			No noticeable display defect or ununiformity should be observed.		Use the criteria for judgment specified in the section 11.

※ Measured in the form of LCD module.

11. Criteria of Judgment

11.1 Defective Display and Screen Quality

Test Condition: Observed TFT-LCD monitor from front during operation with the following conditions
 Driving Signal Raster Patter (RGB in monochrome, white, black)
 Signal condition [Data]: 3Fh, 1Ah, 00h (3steps)
 Observation distance 30 cm
 Illuminance 200 to 350 lx
 Backlight IL=50mA

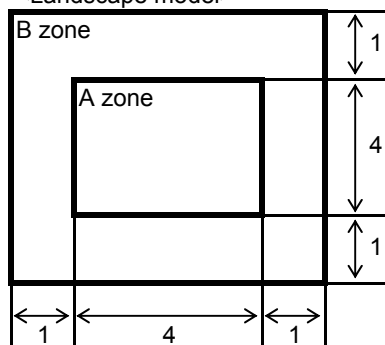
Defect item		Defect content		Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots		Not exists
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 2% ND filter at [Data]=00h Low bright dot: Visible through 5% ND filter at [Data]=00h Dark dot: Appear dark through white display at [Data]=1Ah		Refer to table 1
Screen Quality	Dirt	Point-like uneven brightness (white stain, black stain etc)		Invisible through 1% ND filter
	Foreign particle	Point-like	$0.25\text{mm}<\varphi$	N=0
			$0.20<\varphi\leq 0.25\text{mm}$	$N\leq 2$
			$\varphi\leq 0.20\text{mm}$	Ignored
		Liner	$3.0\text{mm}<\text{length and } 0.08\text{mm}<\text{width}$	N=0
			$\text{length}\leq 3.0\text{mm or width}\leq 0.08\text{mm}$	Ignored
	Others			Use boundary sample for judgment when necessary

$\varphi(\text{mm})$: Average diameter = (major axis + minor axis)/2
 Permissible number: N

Table 1

Area	High bright dot	Low bright dot	Dark dot	Total	Criteria
A	0	2	2	3	Permissible distance between same color bright dots (includes neighboring dots): 3 mm or more
B	2	4	4	6	Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
Total	2	4	4	7	

<Landscape model>



Division of A and B areas

B area: Active area

Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

11.2 Screen and Other Appearance

Testing conditions

Observation distance

30cm

Illuminance

1200~2000 lx

Item		Criteria	Remark
Polarizer	Flaw	Ignore invisible defect when the backlight is on.	Applicable area: Active area only (Refer to the section 3.2 "Outward form")
	Stain		
	Bubble		
	Dust		
	Dent		
S-case		No functional defect occurs	
Connector		No functional defect occurs	

12. Reliability Test

Test item		Test condition	number of failures /number of examinations
Durability test	High temperature storage	Ta=80° C 240H	0/3
	Low temperature storage	Ta=-30° C 240H	0/3
	High temperature & high humidity storage	Ta=60° C, RH=90% 240H non condensing ※	0/3
	High temperature operation	Tp=70° C 240H	0/3
	Low temperature operation	Tp=-20° C 240H	0/3
	High temp & humid operation	Tp=40° C, RH=90% 240H non condensing ※	0/3
	Thermal shock storage	-30←→80° C(30min/30min) 100 cycles	0/3
Mechanical environmental test	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±12kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.	0/3
	Vibration test	Total amplitude 1.5mm, f=10~55Hz, X,Y,Z directions for each 2 hours	0/3
	Impact test	Use ORTUS TECHNOLOGY original jig (see next page)and make an impact with peak acceleration of 1000m/s ² for 6 msec with half sine-curve at 3 times to each X, Y, Z directions in conformance with JIS C 60068-2-27-2011.	0/3
Packing test	Packing vibration-proof test	Acceleration of 19.6m/s ² with frequency of 10→55→10Hz, X,Y, Zdirection for each 30 minutes	0/1 Packing
	Packing drop test	Drop from 75cm high. 1 time to each 6 surfaces, 3 edges, 1 corner	0/1 Packing

Note: Ta=ambient temperature Tp=Panel temperature

※ The profile of high temperature/humidity storage and High Temperature/humidity operation
(Pure water of over 10MΩ·cm shall be used.)

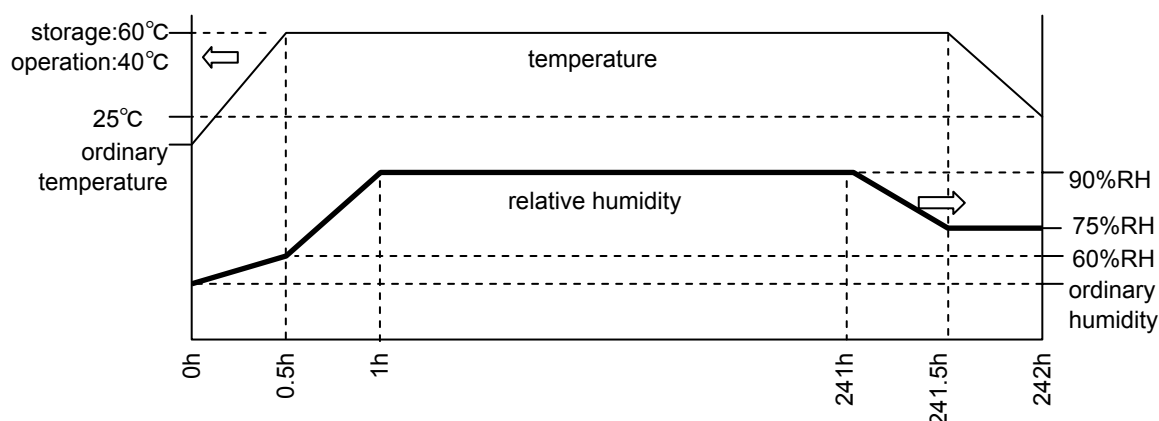
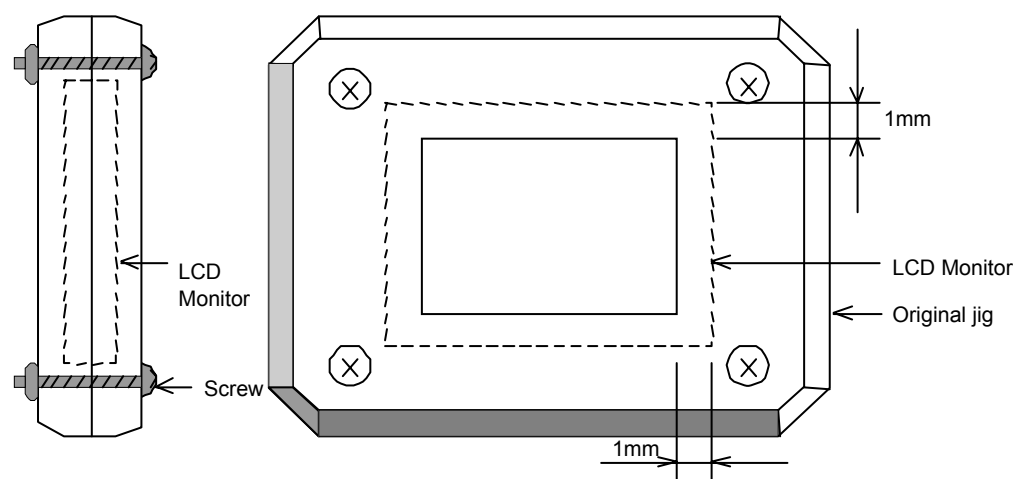


Table2.Reliability Criteria

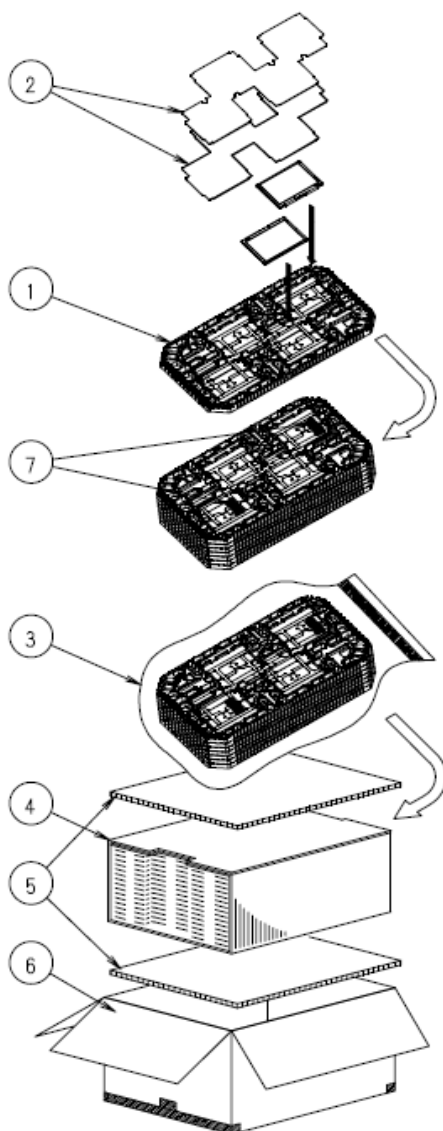
Measure the parameters after leaving the monitor at the ordinary temperature
for 24 hours or more after the test completion.

item	Standard	Remarks
Display quality	No visible abnormality shall be seen.	
Contrast ratio	40 or more	

ORTUS TECHNOLOGY Original Jig



13. Packing Specifications



Step.1 Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.(4products per tray)
Antistatic foam sheet is to be placed on the products in the tray.

Step.2 Each tray needs to be same orientation respect to the tray below or above it and the trays be in a stack of 6.
One empty tray is to be put on the top of stack of 6 trays.

Step.3 2 packs of moisture absorbers are to be placed on the top tray as shown in the drawing.
Put piled trays into a sealing bag.
Vacuum and seal the sealing bag with the vacuum sealing machine.

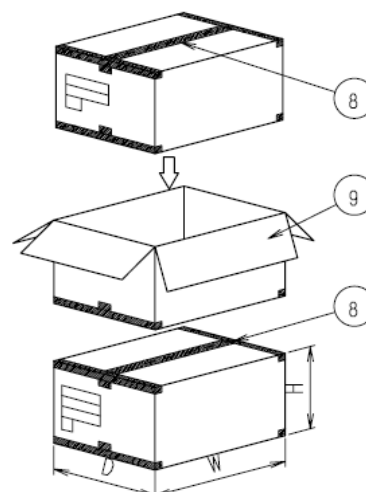
Step.4 The stack of trays in the plastic back is to be inserted into a inner carton.

Step.5 A corrugated board is to be placed on the top and on the bottom of the inner carton.
The two corrugated boards and the inner carton is to be inserted into an outer carton.

Step.6 The outer carton needs to sealed with packing tape as shown in the drawing.
The model number, quantity of products, and shipping date are to be printed on the outer carton.
If necessary, shipping labels or impression markings are to be put on the outer carton.

Step.7 The outer carton is to be inserted into a extra outer carton with same direction.
The extra outer carton needs to sealed with packing tape as shown in the drawing.

Step.8 The model number, quantity of products, and shipping date are to be printed on the extra outer carton
If necessary, shipping labels or impression markings are to be put on the extra outer carton.



Remark: The return of packing materials is not required.

	Packing item name	Specs., Material
①	TRAY	A-PET(Antistatic)
②	FOAM SHEET	Anti-static polyethylene
③	SEALING BAG	
④	INNER CARTON	Corrugated cardboard
⑤	INNER BOARD	Corrugated cardboard
⑥	OUTER CARTON	Corrugated cardboard
⑦	Drier	Moisture absorber
⑧	Packing tape	
⑨	EXTRA OUTER CARTON	Corrugated cardboard

Dimension of extra outer carton

D : Approx.	(338mm)
W : Approx.	(549mm)
H : Approx.	(198mm)
Quantity of products packed in one carton:	4pcsx6=24pcs
Gross weight : Approx.	6.4Kg

14. Handling Instruction

14.1 Cautions for Handling LCD panels

**Caution**

- (1) Do not make an impact on the LCD panel glass because it may break and you may get injured from it.
- (2) If the glass breaks, do not touch it with bare hands.
(Fragment of broken glass may stick you or you cut yourself on it.)
- (3) If you get injured, receive adequate first aid and consult a medial doctor.
- (4) Do not let liquid crystal get into your mouth.
(If the LCD panel glass breaks, try not let liquid crystal get into your mouth even toxic property of liquid crystal has not been confirmed.)
- (5) If liquid crystal adheres, rinse it out thoroughly.
(If liquid crystal adheres to your cloth or skin, wipe it off with rubbing alcohol or wash it thoroughly with soap. If liquid crystal gets into eyes, rinse it with clean water for at least 15 minutes and consult an eye doctor.)
- (6) If you scrap this products, follow a disposal standard of industrial waste that is legally valid in the community, country or territory where you reside.
- (7) Do not connect or disconnect this product while its application products is powered on.
- (8) Do not attempt to disassemble or modify this product as it is precision component.
- (9) For protection your circuit, we recommend you to add excess current protection circuit to power supply.

**Caution**

This mark is used to indicate a precaution or an instruction which, if not correctly observed, may result in bodily injury, or material damages alone.

14.2 Precautions for Handling

- 1) Wear finger tips at incoming inspection and for handling the TFT monitors to keep display quality and keep the working area clean.
Do not touch the surface of the monitor as it is easily scratched.
- 2) Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors as the LED in this TFT monitors is damageable to electrostatic discharge.
Designate an appropriate operating area, and set equipment, tools, and machines properly when handling this product.
- 3) Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors for protecting their glass parts. Do not use the TFT monitors that have been experienced dropping or strong mechanical shock.
- 4) Do not use or storage the TFT monitors at high temperature and high humidity environment. Particularly, never use or storage the TFT monitors at a location where condensation builds up.
- 5) Avoid using and storing TFT monitors at a location where they are exposed to direct sunlight or ultraviolet rays to prevent the LCD panels from deterioration by ultraviolet rays.
- 6) Do not stain or damage the contacts of the connector .
FPC cable needs to be inserted until it can reach to the end of connector slot.
During insertion, make sure to keep the cable in a horizontal position to avoid an oblique insertion.
Otherwise, it may cause poor contact or deteriorate reliability of the connector.
- 7) Peel off the protective film on the TFT monitors during mounting process.
Refer to the section 14.5 on how to peel off the protective film.
We are not responsible for electrostatic discharge failures or other defects occur when peeling off the protective film.
- 8) The volume attached to the monitor is set to the optimal value at the time of shippment from our factory, so please do not change it.

14.3 Precautions for Operation

- 1) Since this TFT monitors are not equipped with light shielding for the driver IC, do not expose the driver IC to strong lights during operation as it may cause functional failures.
- 2) When turning off the power, turn off the input signal before or at the same timing of switching off the power.
- 3) Do not plug in or out the connector while power supply is switch on.
Plug the connector in and out while power supply is switched off.
- 4) Do not operate the TFT monitors in the strong magnetic field. It may break the TFT monitors.
- 5) Do not display a fixed image on the screen for a long time.
Use a screen-saver or other measures to avoid a fixed image displayed on the screen for a long time.
Otherwise, it may cause burn-in image on the screen due the characteristics of liquid crystal.

14.4 Storage Condition for Shipping Cartons

Storage environment

- Temperature 0 to 40° C
- Humidity 60%RH or less
No-condensing occurs under low temperature with high humidity condition.
- Atmosphere No poisonous gas that can erode electronic components and/or wiring materials should be detected.
- Time period 3 months
- Unpacking To prevent damages caused by static electricity, anti-static precautionary measures (e.g. earthing, anti-static mat) should be implemented.
- Maximum piling up 7 cartons

14.5 Precautions for Peeling off the Protective film

The followings work environment and work method are recommended to prevent the TFT monitors from static damage or adhesion of dust when peeling off the protective films.

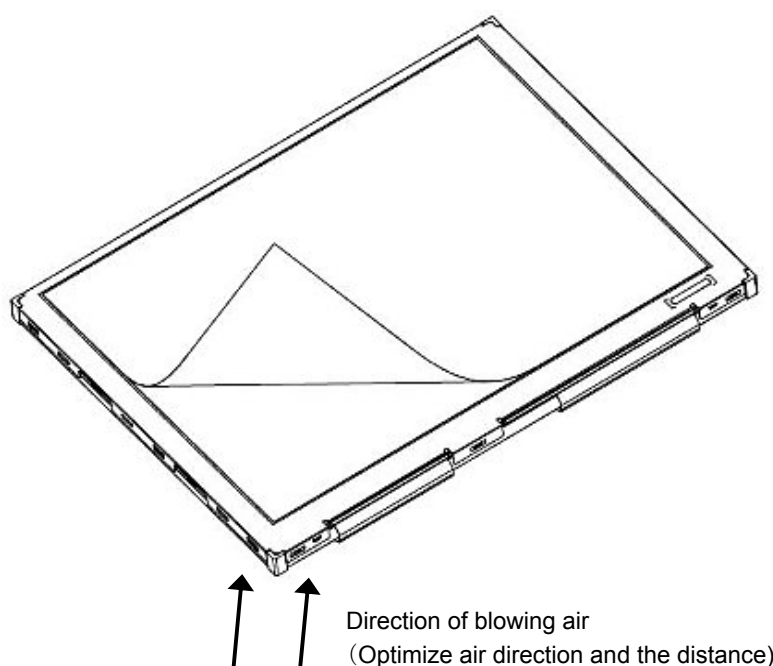
A) Work Environment

- a) Humidity: 50 to 70 %RH, Temperature 15 to 27° C
- b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Anti-static treatment should be implemented to work area's floor.
- c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

B) Work Method

The following procedures should be taken to prevent the driver ICs from charging and discharging.

- a) Use an electrostatic neutralization blower to blow air on the TFT monitors to its lower left when "S LABEL" on the front case is placed at the bottom.
Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Put an adhesive tape (Scotch tape, etc) at the lower left corner area of the protective film to prevent scratch on surface of TFT monitors.
- c) Peel off the adhesive tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition

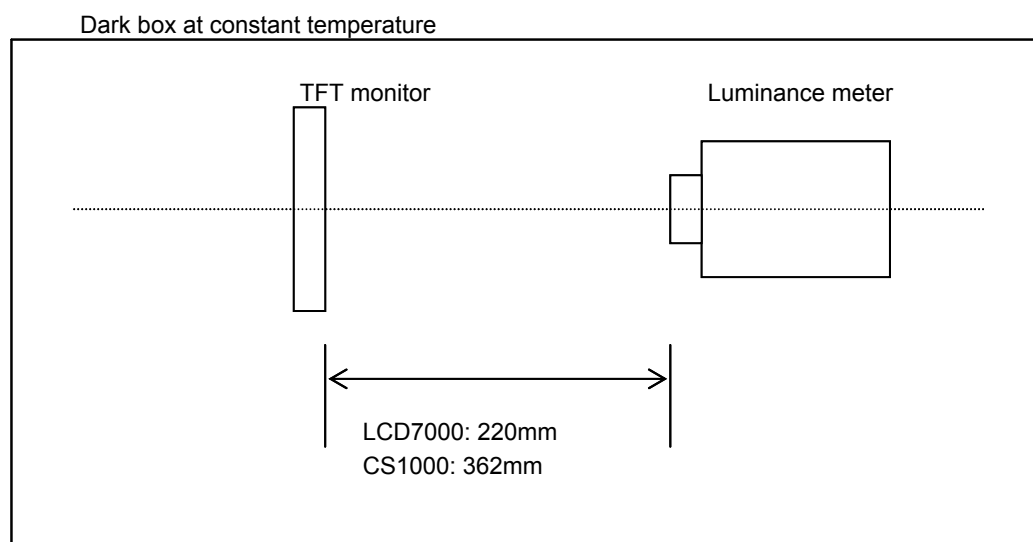
Measuring instruments: CS1000 (KONICA MINOLTA) , LCD7000(OTSUKA ELECTRONICS) ,EZcontrast160D (ELDIM)

Driving condition: Refer to the section "Optical Characteristics"

Measured temperature: 25°C unless specified

Measurement system: See the chart below. The luminance meter is placed on the normal line of measurement system.

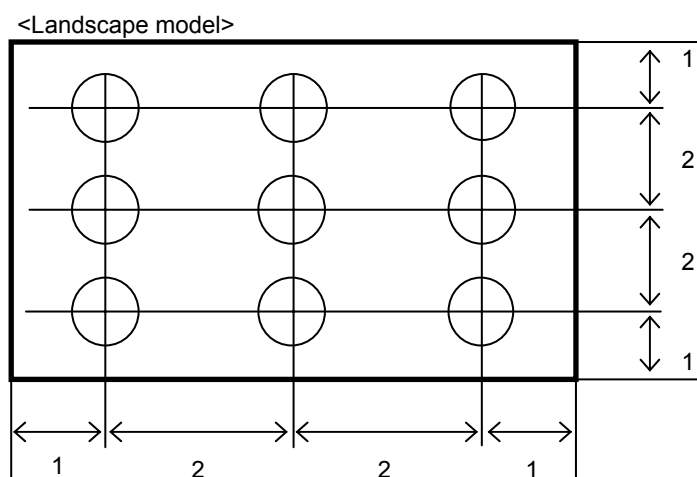
Measurement point: At the center of the screen unless otherwise specified



Measurement is made after 30 minutes of lighting of the backlight.

Measurement point: At the center point of the screen

Brightness distribution: 9 points shown in the following drawing.



Dimensional ratio of active area

Backlight IL=50mA

2. Test Method

Notice	Item	Test method	Measuring instrument	Remark
1	Response time	<p>Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.</p>	LCD7000	<p>Black display [Data]=00h White display [Data]=3Fh TON Rise time TOFF Fall time</p>
2	Contrast ratio	<p>Measure maximum luminance Y1([Data]=3Fh) and minimum luminance Y2([Data]=00h) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values.</p> <p>Contrast ratio = Y1/Y2</p> <p>Diameter of measuring point: 8mmφ</p>	CS1000	
3	Viewing angle Horizontalθ Verticalφ	Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is 10.	EZcontrast160D	
4	White chromaticity	<p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = 3Fh</p> <p>Color matching faction: 2°view</p>	CS1000	
5	Burn-in	Visually check burn-in image on the screen after 0.5 hours of "window display" ([Data]=3Fh/00h).		At optimized VCOMDC
6	Center brightness	Measure the brightness at the center of the screen.	CS1000	
7	Brightness distribution	<p>(Brightness distribution) = 100 x B/A %</p> <p>A : max. brightness of the 9 points</p> <p>B : min. brightness of the 9 points</p>	CS1000	